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AUTHOR Fink, Edward J.
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ABSTRACT

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Edward J Fink PhD
Dept Comm Cal State
Fullerton CA 92834-6846

Phone: 714-278-5399
Fax: 714-278-2209
E-mail: efink@fullerton.edu

Edward J. Fink (Ph.D., Indiana University, 1993) is Assistant Professor for Television and Film in the Department of Communications at California State University, Fullerton.

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The Transition to Digital Video: What Lessons Have We Learned So Far?

The proliferation of digital technology is changing video production education. Computers continue to be integrated into the learning process. It is important for video production educators to understand and evaluate the issues that arise from the incorporation of this technology. The objective of this study is such an assessment.

Literature Review

Digital technology is the subject of numerous writings. Some authors address the technical aspects of these new media (Barron, 1995; Clarke, 1995; McGoldrick, 1996; Rzeswski, 1995; Shepherd, 1993; Solari, 1996; Tekalp, 1995). Some describe hardware and software (Ankeney, 1996; Bournellis, 1995; DeVoe, 1996; Mullen, 1997; Taufour, 1994). Some examine the applications and uses of digital media systems (Baxes, 1994; Mattison, 1994; Rodriguez, 1995; Stone & Johnson, 1994; Sykes & Swinscoe, 1995; Watkinson, 1994a). Some focus on digital processes (Gilster, 1997; Ohanian, 1993; Ozer, 1996; Rubin, 1995; Watkinson, 1994b). Some discuss approaches to digital production and editing (De Leeuw, 1997; Galbreath, 1992; Grey, 1995; Korpi, 1995; Levin & Watkins, 1997; Luther, 1994; Ohanian & Phillips, 1996; Wolff, 1996). Some compare uses of analog and digital technology (Kindem & Musburger, 1997; Rosen, 1996). Others look at issues of culture (Darley, 1995), finance (Schonfeld, 1996), globalization (Gross, 1995), jobs (Altman, 1995), and policy (*Advanced Digital Video*, 1995). Many trade magazines also publish articles concerning the digital media world (e.g., any recent issue of *Film & Video*, *TV Technology*, *Video Systems*, and the like). None of these writings, however, directly addresses the impact of digital technology on video production education. That is the focus of this paper.

Methodology

The methodology for this study followed the guidelines of the interpretive research paradigm. Respondents were contacted in accordance with Lincoln and Guba's (1985) "hermeneutic circle" to arrive at "emerging consensus" concerning the relevant issues. Qualitative data were collected from 48 respondents in 1996-97, all practitioners or educators in media production, six of them from foreign countries (see Appendix A). A combination of non-participant field observations, face-to-face interviews, and open-ended mail surveys was used (see Appendix B). The data were then analyzed using Lindlof's (1995) guidelines for inductively arriving at a "conceptual structure" for reduction and categorization.

Findings

Four general categories may be induced from the responses to form the conceptual structure of the findings. These include replies concerning the impact of digital technology on: (1) the production process, (2) curriculum, (3) class interaction, and (4) budgeting. Each of these general topics may be further divided into subcategories. Though some responses are unique,[1] the emphasis here is on commonalities. This discussion of similar responses by category offers a framework for readers to assess the validity and transferability of these findings to their own situations as they make decisions concerning the transition to digital video.

Production Process

In keeping with tradition, the impact of digital technology on the production process is examined in terms of the phases of (A) preproduction, (B) production, (C) postproduction, and (D) distribution.

Preproduction

The respondents agree that preproduction planning remains vital to the success of any production. No matter how slick the bells and whistles of the acquisition and editing technology, a good script and well-planned story progression are necessary for a successful film or video.

Writing and breakdown. Students and instructors in most writing courses utilize writing software for class exercises. These range from traditional word-processing programs, such as Microsoft Word, to dedicated screenwriting programs, such as Final Draft. Though not as frequently used as writing programs, other software is sometimes used in production classes, such as MovieMaster for script breakdowns, scheduling, and budgeting.

Other. Additional software assists with storyboarding, light/set/costume design, and even simulated "walk-throughs" in 2-D or 3-D. These latter programs seem to be utilized more in Art and Theater Departments and less in Communication, Video, and TV-Film Departments. This makes sense, given that most professional storyboard artists and designers come from backgrounds in Art and/or Theater. To the extent that instructors in these departments collaborate in production, digital technology can help with communication, such as sharing script revisions via e-mail.

Production

Digital technology impacts the image and sound acquisition phase of production more today than just a few years ago. As digital products become more affordable, educators are able to utilize them for learning.

Video. Digital cameras just became practical for the educational market in the 1996-97 academic year as major manufacturers (Sony, Panasonic, JVC) introduced digital "prosumer" cameras, which rival the image quality of the professional analog Beta format but record on 6mm cassettes, for under $4000. Other digital media also continue to decrease in price, such as internal and external computer drives for storage.

Audio. Several respondents note that digital audio is more affordable than digital video and therefore can be used to offer students a digital production experience. Digital audio tape (DAT) equipment continues to come down in price. Audio also does not require as much storage in a computer as does video, so direct-to-drive recording is more feasible for audio acquisition than for video.

Technical and aesthetic quality. Digital image and sound quality depends on the sophistication of the equipment and the extent to which the image or sound is compressed. Nearly all respondents note the continuing importance of emphasizing aesthetic quality, such as lighting, composition, and so on (discussed later in the "Curriculum" section). If students do not learn these fundamentals, then the potentially higher quality images will still look bad aesthetically, but they will look bad with greater technical resolution.

Design. Digital technology makes possible the design concepts of virtual sets with virtual lights, as well as virtual wardrobes and even virtual makeup. While some doomsayers see this trend leading to no more set construction, lighting grids, costume sewing, and makeup on faces, that trend is not close to being realized. For example, a realistic, complex set, combined with believable camera and actor movements, is a lot to ask a computer to generate. Virtual sets that are graphics-generated backgrounds are common, but for realistic drama and comedy, traditional set, light, costume and makeup design will continue for some time, though digital technology will certainly continue to impact them, especially in generating design plans.

Animation. In animation, computer generated images (CGI), as well as sounds, continue to make inroads. Most animated films and videos utilize computers for at least part, if not all, of their creation. Relating this to production education, animation can be used to teach many basics, such as lighting, composition, and editing. To the extent that instructors and students find animation an affordable and useful learning tool, digital technology can impact the production phase in creating animated imagery and sound.

Graphics and other. In the field of graphics production, digital technology has certainly had a significant impact. Nearly all graphics are generated or edited in computers. Additional uses for digital technology in production include electronic field logging (using a laptop computer) and nonlinear editing in the field, which can help in making decisions about what scenes to reshoot.

Convergence of media. Several respondents address the theme of the convergence of various media in the digital realm. The skills of text generation, graphic design, photography, audio, and video all come together in the binary world. Those who work in production, no matter their specialties, utilize computers in their daily activities. Entire programs, whether audio, video, or multimedia, can be originated in computers.

Convergence of locations. Another type of convergence, certainly in the acquisition phase, but also in pre- and postproduction, is the convergence of communication from multiple locations. Films and television programs can be "assembled" from different places, utilizing technologies such as electronic mail, fax, and digital sound and movie files transmitted via an Integrated Systems Digital Network (ISDN).

Convergence of acquisition and editing. Yet another type of convergence is the merging of the acquisition, or production, phase of a project and its editing, or postproduction. Editing, or "posting," can begin while shooting continues, rather than waiting for all the shooting to finish in order to edit the shots in linear sequence. In the nonlinear world of digital video, an editor can begin work on a program as soon as the first "dailies" come in.

Postproduction

All the respondents agree that digital technology has the greatest impact in the postproduction phase, specifically in editing. Once students, as well as professionals, achieve the learning curve to use the technology, they are able to make edits faster and experiment with more editing options.

Video. As the price of video editing software continues to become more affordable, schools will utilize it more and more. But analog tape will be around for a while. Most projects end up on VHS tape for viewing, so that alone argues for the utility of some analog technology in an increasingly digital world. When analog tape is the end product, investing in the highest-end digital output capability is not justified.

Shelley Jenkins, an independent producer, offers an interesting hypothesis concerning digital video postproduction: Digital video will actually lead to more analog tape than before. She notes that in the early 1980s computer word-processing, mail, and other forms of electronic writing were predicted to replace paper. If anything, society consumes more paper today than before, arguably in part because of computers that make it easy to write, draw, layout, and then print to paper for copying and sharing with others. Likewise, as digital video becomes more affordable, more people will create their own videos and "print" them to tape for copying and sharing with others. The concept of a "tapeless" video world may be proven as wrong as the concept of a "paperless" communication world.

Audio. Some respondents point out that audio postproduction is already quite affordable, while video post continues to come down in price. Many audio instructors already teach postproduction editing on computers. Software, such as ProTools or the more affordable SoundEdit 16, allows students and professionals alike to process audio in the digital realm, taking advantage of the relative ease, speed, and versatility of digital audio post.

Technical quality and correction. Posting digitally retains the technical quality of the original sound and image because there is no generation loss when copying digital files for editing and outputting, unlike the loss that occurs when dubbing analog tapes for editing and distribution. This lack of generation loss results in a superior quality rough cut for clients and producers. Digital technology can also correct defects. Sophisticated equipment can search for interruptions in data streams and fix them. Technology can also be used to manipulate elements in image and sound, such as "matting" backgrounds and adjusting audio "envelopes."

Aesthetic quality. In addition to providing improved technical quality for rough cuts, digital editing can also improve the aesthetic quality. Because the speed of digital editing allows time to experiment with more options, a digital rough cut can offer more sophisticated shot juxtaposition and sound layering than an analog edit. This gives the producers or clients a better idea of how the final product might look and sound.[2]

Time. The issue of time savings in postproduction is important to many respondents. While they agree that digital editing is faster than analog, allowing edits to be made more quickly, they also point out that saving time is only realized after the editors have learned the technology. Additionally, once students learn digital editing, they tend to enjoy experimenting and spend just as much time, if not more, in the editing suites.

Digitizing. In the midst of mostly positive responses concerning the eventual time savings of digital video editing, a few salient responses concerning digitization stand in contrast. Alexandra Hedberg, Swedish Television (SVT), discusses the need for her news editors to digitize analog footage (Beta) into the workstation (Avid) to edit it, then put it back out to analog tape for broadcasting. It is far too expensive for SVT to convert to an entirely digital system, from acquisition through transmission, so while analog technology is still used in daily operations, the editors actually *lose* time because of the need to convert footage between analog and digital.

Storage and sharing. Digital technology allows file storage and sharing that is not possible with analog media. The ability to store and share information easily, however, leads to a problem in sharing computer work space. Limited drive storage demands that a student often finish a project in one sitting, from input through editing to output. This is not realistic. It causes students friction and stress and can actually lead to less creative output. Offering external hard drives (e.g., Jazz, Syquest, etc.) and requiring the students to purchase cartridges is one solution, but this may not be affordable for everyone.

Digital Depot. Another solution, though even more expensive, is the concept of a digital depot. All digital media files, including text, graphics, sound, and still and motion images, are stored in a central server, or "depot," and can be accessed by whomever needs to access them for decision making, effects rendering, editing, and so on, like different trains entering and departing a depot. For educators, a central storage space, or local area network (LAN), for all digital files that all students can access for learning offers intriguing possibilities. For example, the instructor and students could post files to this depot for sharing with the class and for working on projects. Gross and Ward further explicate this concept (1997, p. 256).

Distribution

Digital technology impacts the distribution of programs, as well as their production. Computers are used for everything from poster design for promotion to tracking shipments of film prints and videotapes.

Entire programs. Productions themselves may be distributed digitally. For instance, Russell Myerson, The Gameshow Network, notes that his is the first all-digital network. All gameshows purchased by the network are transferred to the Digital Beta (DigiBeta) format from whatever medium was used for archiving. Additionally, all programming originated by the network goes to DigiBeta. Moreover, film distributors and exhibitors are exploring satellite transmission of movies to theaters using high definition digital video and audio.

The Web. Some respondents point out that the World Wide Web offers a relatively new outlet for distributing productions. Though currently the technology is rather slow and the image quality is rather poor for posting entire movies on the web, short audio clips of under one minute and video clips of 10-15 seconds may be found at many websites. The potential for producers to have their work screened electronically on the web will continue to be realized more and more as the technology for fast, high quality image and sound transfer improves.

Servers. Reg Russ, Television New Zealand, asserts that server-based linear and non-linear playout directly from hard drives, including possibilities for user interactivity, creates many opportunities:

> Digital video provides efficiencies, versatility and economics, which enable high quality products for niche markets in the visually rich information era we are now entering. Old tasks that might have been done verbally or in writing may now be done in pictures. Pictures are the tools of the communicators to the new millennium and a visually rich, stimulating communications systems with interactivity to allow the choice of content at the user end is the emphasis which is required.

Summary

Potential. The respondents agree that digital technology has the potential to make all phases of the production process more efficient, leading to more creative output. It also has the potential to provide higher quality images and sound than current analog technology, especially as higher-end digital equipment becomes more affordable for universities. Finally, production creators will have greater opportunities in the future to distribute their work digitally.

Actual. However, there is some disagreement concerning the actual extent to which this potential is realized. The limited budgets of most universities do not allow a significant number of digital workstations for the students to realize their creations. Moreover, with limited storage capacity, the quality of the video must usually be compressed, yielding small-image, pixelated movies rather than attractive, full-screen, full-motion, broadcast video. For the World Wide Web, high-quality, full-screen movies are not yet practical, given the slowness of most people's computer systems, though this will change as the technology progresses.

Jenkins notes that, while producers have digital tools to improve their preproduction planning and shooting, she rarely sees them take advantage of that. More likely is that producers spend less time in planning and setting up shoots, relying on digital bells and whistles to fix any problems in post, which can lead to poorer aesthetics because not every problem can be repaired in editing. Moreover, some producers wait until post to make their critical decisions, which can yield a weaker story and message. By not planning shots in advance, a producer might select sequences based on what is technologically possible at the moment, rather than on what is best for the script.[3] To the extent that this is true, it is a dangerous trend. The need for solid planning remains critical to the success of production.

Curriculum

The respondents offer insight concerning the impact of digital technology on media production curriculum. Specifically, they address the need for those developing curriculum to: (A) integrate change, (B) balance time between skills training and conceptual learning, (C) emphasize fundamental principles, (D) be interdisciplinary, (E) evaluate continuously, (F) offer real-world relevance, and (G) consider distance learning.

Integrate Change

The respondents point out that production professionals utilize digital technology more and more, therefore this technology must be integrated into the learning curriculum. It is important for students to have some knowledge of, and experience with, the processes used in the production industry in order for them to be prepared to work in that industry.

Flexibility. Lynne Gross of Cal State Fullerton notes that some instructors have added modules to their syllabi concerning digital production, including interactive multimedia. Ralph Donald of the University of Tennessee argues for a different approach: The curriculum should be revised to incorporate digital technology throughout, not to segregate the technology into modules. It is the concepts that are important, and technology should be integrated only as a means to realize those concepts.

Russ offers this advise concerning the integration of technology into the curriculum:

> The approach to digital media is of flexibility -- open-ended instruction from which creative students may derive new ideas and new approaches.... The curriculum revisions likewise have to include open-ended components to allow for topical updates. The basic teaching program has to be reviewed frequently.

Transition. Gross offers another point about integrating digital technology: "Once [students] have tasted it, they don't want to go back." This leads her and others to look forward to the day when they can make the transition entirely to a digital environment. Others caution against dumping analog technology too soon. Musburger summarizes the arguments for this cautionary approach:

> Students can learn the process (maybe not the aesthetic techniques) faster on analog post production equipment than digital [though it must be noted that many respondents, including Jenkins and Kearns, find the opposite in their classes].... We are being forced... to bring digital techniques into the classroom before the "real world" has... decided which will become the standard.... Most broadcasters are moving to digital only as rapidly as they are forced to do so.

These points suggest that universities follow the industry and gradually make the transition to digital technology, rather than abandoning analog technology at the first opportunity.

Though the argument for gradual integration of digital video into the curriculum has logical support, two arguments stand out for the opposite view -- going digital as quickly as feasible. First, the industry is typically years ahead of academia in its technology. Second, the balance of time in the class setting is critical.

Balance Time

Educators must consider the balance of time in class between skills training and conceptual learning. Instructors in the analog environment necessarily devote a certain amount of their courses to hands-on training, and that continues in the digital environment with software training. If an instructor finds her/himself using both analog and digital technologies during a transition period, that increases the amount of class time necessary for skills training.

Dual technologies. This author, for example, is in just such a position: integrating one short digital exercise (15-second PSA) using a very low-end video editing application (VideoShop) during limited hours on some shared computers, while maintaining two longer projects (2-minute documentary and 2-minute narrative) on analog equipment where the students have greater access. I have to train the students on the editing software, which I wouldn't have to do if I had decided to stay in the all-analog environment: a decision I rejected because I believe in the benefits of at least some digital exposure for the students. Additionally, I have to train them on the analog equipment, which I would not have to do in a completely digital environment. Doubling the skills training time means necessarily cutting back on some conceptual content.

Limited computers. To this predicament of balancing skills training with conceptual learning, Musburger adds that the limited number of computers most departments have often dictates that students use them in shifts, which adds even more to the total time spent on skills training. Donald echoes many of the respondents' concerns when he states: "We need to continue to provide a balance between how much conceptual learning and how much time students are assigned to spend with hardware." Roberts, Jenkins, and others summarize that it is desirable to provide students with as much hands-on as possible, but not to the detriment of learning the aesthetics of production. The emphasis in the curriculum should continue to be the principles of clear storytelling and message dissemination.

Emphasize Fundamentals

All the respondents agree that teaching the fundamental concepts of production, such as good planning and scripting, sound recording, lighting, framing, composition, continuity editing, and so on, remains the most vital element in any production curriculum.

Process. Instructors must adjust their curriculum to some degree to reflect the technology, but the technology has no value in and of itself. It is a process to be used only in realizing a creative production. Jenkins writes:

> Communicating a message, telling a story, selling a product are still the goals of most video productions. The technology used to achieve better images faster was never meant to replace production planning.

Gross agrees when she states:

> The most important consideration to become an effective video communicator is the ability to convey a good story or present an information item clearly. This really has very little to do with technology. In today's video world, people expect special effects and whiz bang presentations, so it behooves students to know how to create these. But lacking a good message, the effects will soon wear thin.

Russ concurs:

> The most important considerations to become effective video communicators are the storytelling abilities -- the skills to research, procure and manipulate the content to tell a story. It's all about content, not technology.

The risk of sacrificing content to technology exists not only in academia but in the professional world, as well. Hedberg writes of news editing at Swedish Television: "I'm afraid the digital technology creates more quantity instead of quality." The ability to experiment more with digital editing equipment can lead to more edits, but not necessarily better edits.

Application. Having agreed on the point that conceptual considerations are paramount, some respondents note that in order to apply these considerations, students must necessarily have enough skills training to produce projects. If those skills can be with digital equipment, the students arguably have a leg-up finding work in an industry that continues to "go digital." To that end, Jenkins agrees that technical skills must be a part of the curriculum, but she argues for introducing the technology only after the aesthetics have been covered.

Others, such as this author, argue that the aesthetic and technical components must be taught simultaneously. Students cannot wait until mid-term to begin to learn equipment. Like shuffling cards, the theory and practice must be folded together, each reinforcing the other. Concepts are best learned when they are immediately applied, so each week's class time should consist of some discussion of conceptual principles (something like the traditional lecture/discussion period) as well as some hands-on work that applies those principles (something like the traditional lab period).

Be Interdisciplinary

Some respondents discuss the role that interdisciplinary cooperation can play in a curriculum where digital technology is integrated. For example, Larry Ward of Cal State Fullerton suggests the idea of requiring a set of software skills before the students enroll in a digital production course. The students could acquire those skills through the extended or continuing education office on campus, or in anther department that uses the same software (such as Photoshop in a Communications or Art Department), or at another campus or junior college, or on their own simply by doing the tutorial that comes with most applications. The students could then be given a skills test, such as editing a short sequence of shots accompanied by audio to demonstrate proficiency with the video editing software, before they are allowed in the class. In addition to sharing skills training, the departments or schools share the cost of equipment.

Cross boundaries. Productions themselves may cross conventional academic boundaries. For example, writing students might create a narrative; film and video students might plan and produce it; art students might design the graphics and other imagery; theater students might design the sets and lights and act in the production; and multimedia students might post the project on the web. Though some respondents suggest this level of inter-departmental cooperation is rare, they note that the various skills needed in production, from scripting through distribution, demand cooperative effort in the professional world, so learning to cooperate in all phases of production at the university can provide students with valuable lessons for their subsequent work.

Denver exemplar. Jeff Rutenbeck, University of Denver, oversees an interdisciplinary Digital Media Program. The approach in forming this program was to invite the entire campus community to participate. Three departments proved to have the greatest stake in the program: Communications, Art, and Math and Computer Science. A cross-disciplinary committee formulated a curriculum that includes an introductory class that introduces the concepts across the fields, some core classes from within each field, and some additional electives for the student's chosen area of specialization. For administrative and budgeting purposes, the program is housed in the Department of Mass Communications and Journalism Studies. This exemplar demonstrates how digital technology crosses conventional boundaries and can lead to interdisciplinary learning.

Evaluate Continuously

Some respondents discuss the need to evaluate curriculum on an ongoing basis in light of changes in both the industry and in technology. A point for instructors to consider is involving real-world practitioners in evaluating their curricula. For example, Martin Aichele, College of Furtwangen, Germany, consults with working professionals to determine their needs in the industry. He brings guests into his classes at times to evaluate student work. He also utilizes a scoring sheet for projects that borrows its evaluative criteria from working professionals, incorporating into his curricula categories and point assignments that industry employers recommend.

Real-World Relevance

Bottom line. In addition to evaluating curriculum for technological relevance, several respondents discuss the need for other real-world relevance. Brad Mooberry, Ad Dimension II, argues for the importance of students learning that the production business, whether audio, video, film, or multimedia, is driven by the bottom line: money. For instance, the CD-ROMs he produces are sponsored by advertisers who get photo ads on the disks themselves and multimedia ads at different spots along the nonlinear, interactive "paths." Advertising revenue drives the industry.

Goal-orientation. Dave Master, Warner Bros. Feature Animation, argues for real-world goal orientation in developing curriculum. He notes that his company hires animators not based on any digital equipment skills but on artistic ability, specifically the applicants' portfolios. Because a portfolio is an artist's entry into film animation, the distance learning art courses he supervises are designed with the goal of each student creating a marketable portfolio. In essence, Master works backwards. Instead of deciding what text chapters and lecture material to cover each day and when to schedule exams, he starts planning with the end product -- student portfolios -- and works back from there, planning each days' exercises to take the students one step closer to that objective.

Distance Learning

Distance learning is a hot concept in education today, made possible by digital technology. Much has been written about distance learning, far more than can be discussed here. For this study, it must suffice to note the importance of this learning strategy and its relation to technology, but to refer the reader to the education literature for in-depth treatment of this salient topic.

The impact of distance learning on media production education specifically offers intriguing potential. Sample video clips and production projects can be transmitted interactively between different locations, opening up learning possibilities beyond any single classroom on any single campus. For example, Steven Spielberg could visit a studio classroom next door to his DreamWorks complex at Universal Studios in southern California and offer a live, interactive critique of a student film in Fort Wayne, Indiana. Because of such possibilities, distance learning curriculum is mentioned as a relevant issue in this study of digital technology, but given that this subject is treated elsewhere, it is not detailed here.

Summary

Potential. Digital technology opens many creative possibilities in curricular design. The technology itself, though, must be learned only as a tool to develop the more important aesthetic concepts of production. With the emphasis on aesthetic fundamentals, and with an eye on real-world relevance, digital equipment can be very useful in reinforcing student learning.

Actual. In reality, training on digital equipment takes time, perhaps more or less than on analog equipment, depending on the sophistication of the system. Instructors often find they need to spend more time than they would like on skills training to the detriment of teaching the theoretic concepts of production. Also, maintaining relevant training for the real world, both technically and aesthetically, poses problems of time and

money for instructors. The challenge for production educators is to stay abreast of production techniques in the industry and to find the proper balance in class between the necessary technical training and the more important conceptual learning.

Class Interaction

Related to curriculum is the actual interaction among students and instructors in the class setting (I avoid the term "classroom" because learning can take place anywhere, inside or outside traditional rooms for class meetings). Respondents discuss some ways in which digital technology impacts the class setting, both for (A) instructors and for (B) students.

Instructors

Technology training. Many respondents note the challenge for instructors to be trained in the digital technology they use in their classes, from audio editing to image processing to multimedia authoring. Because this issue is relevant in the discussion of budgeting in the paragraphs ahead, it is addressed again later.

Industry. The need for technical training exists in the industry as well as in academia. Hedberg, for example, notes that her editors have a difficult time getting trained on the Avid before their first deadline for a news package. She writes: "New technology is a great help if you have *time* to learn and explore it. If not, it creates stress."

Instructional training. In addition to skills training using the relevant hardware and software, instructors need new skills in instructional design and the preparation process for teaching. Much rhetoric exists in academia today concerning the shift from a "lecture," or "teaching," paradigm to an "interactive," or "learning," paradigm.[4] The role of the instructor is changing, and perhaps has already changed, from the traditional disseminator of knowledge (lecturer) to that of an interactive facilitator: one who initiates, guides, and oversees the interaction of students with students, students with instructors, and students with computers. Developing the skills to facilitate interactive learning while moving away somewhat (though never completely) from traditional lecturing is a challenge for production instructors in the digital age. Russ offers one suggestion to meet this challenge: "Use real world visionaries from the industry to paint the present and future scene for the students, rather than implant the old ways of doing things."

Students

Interaction. Learning through interactive group efforts, along with computers, has a significant impact on students in an era of digital technology. Students can no longer expect to be passive absorbers of facts (if they ever could). Learning must be a process of discovery through cooperative efforts with others, often enhanced by hands-on learning activities (which it might have always been).

Working in groups is a reality of education today, and with increasing demand to use limited digital workstations for various production exercises, group projects will only continue to grow in significance. Students must increasingly be responsible to take the initiative for their own level of work. The downside is that less adept students might be "left in the dust" much quicker.

Computers. Several respondents note the importance of computer skills for students to be successful: certainly in the workplace after graduation, but increasingly in the school environment itself. Those who hire in the industry understand that students cannot be expected to have the software training necessary for high-end applications, such as 3-D modeling and rendering (though they often expect skills with some nearly-standard applications, such as Microsoft Word). The students can learn the high-end software on the job. What is required is a level of comfort and skill with computers in general: formatting disks, copying files, using pull-down menus to select options, and so on.

A few respondents assert that in the near future even skills training on high-end applications might be expected because universities and trade schools are turning out more and more graduates who have those skills. In an effort to keep their students competitive, some schools are investing in high-end applications so that their graduates have high-end training, as well as the necessary conceptual learning. Moreover, Donald observes:

> Despite their claims to the contrary, employers hire graduates who are both conceptually literate *and* equipment-skilled. Many graduates applying for entry-level media jobs have both sets of these skills and abilities.... [Employers] select the bright, intelligent, well-spoken young person who can demonstrate that s/he can do it all. Anyone less skilled need not apply.

Writing. Some respondents remark that writing skills are even more important for students than computer skills. For example, Saundra Willis, NBC-4 Los Angeles, notes that she sees many interns who lack the ability to follow the basic rules of grammar, business letter layout, and so on. She looks for students who can both write and use computers, but if she has to choose between one or the other, she prefers a student who can write. Computer skills can be learned fairly quickly; good writing ability takes time to develop.

Passion. Another necessary quality for students to possess in order to be successful in the age of digital production is passion for that production. Mooberry, for instance, notes that he prefers to hire a person who has a "fire in the belly" to do production work. The training can be done later. What can't be taught is the "lustful desire" to do the job.

Summary

Potential. With digital technology, the potential exists for more learning to occur than ever before with instructors facilitating interactive sessions and students becoming more engaged in their own education. As students' computer skills increase along with their conceptual knowledge, the level of learning they bring to the work environment can only increase. In this way, the impact of technology on class interaction can greatly enhance learning.

Actual. An increase in interactive, group learning might leave some students behind, particularly the shy ones, as well as the lazy ones. Also, while interactive learning offers advantages over traditional lectures, there still is the learning curve to figure out the technology. Equipment training takes up some class time before truly interactive learning can take place. Some equipment training is necessary as students are increasingly required to have technical skills (particularly basic computer skills) in addition to conceptual knowledge (especially writing ability) in order to be competitive.

Budgeting

The final set of responses concern elements that relate to budgeting. These include: (A) real costs, (B) annual expenditures, (C) partnerships, (D) access, (E) facilities, (F) staff, (G) training, and (H) educating administrators.

Real Costs

Digital technology comes with a price tag. No respondent knows of a way to get around that. Yet all agree it is a necessary price tag if production students are to receive at least some exposure to the kinds of technical skills that employers increasingly require of them. It is understood that budgets may range from nearly nothing up into six or even seven figures for the lucky few. Whatever the budget, digital technology is a part of the equipment purchasing equation.

Digital v. analog. While the cost of digital production hardware and software continues to drop, it is still an expensive investment for training. Good quality analog equipment can be expensive, too. This author's experience suggests a "break even" point between $10,000 and $15,000. Depending on factors such as purchasing used equipment (B-stock) or getting deep educational discounts, this price range buys a good 3/4-inch, cuts-only system, perhaps even Beta (not DigiBeta), but can also purchase a digital workstation with enough access for students, in small groups, to produce 1-2 minute projects. More money, of course, gets more bells and whistles for either analog or digital, or more speed and storage for digital.

Staying current. A major budgetary concern is how to stay current with digital technology when it becomes obsolete so quickly. The question is how to afford enough workstations for the students to have a meaningful experience, while still emphasizing the conceptual basics of production, and fit the department's meager budget: a challenging task at best, and impossible at worst. Donald asserts it is only possible to take a "snapshot" of the technology when the budget allows, then live with that until the next round of equipment money, hoping that the "snapshot" has enough longevity for the students to learn some practical skills that will help them on their internships and job sites.

Annual Expenditures

These budgetary decisions must be made annually, not just once and then forgotten. It is not enough to make a major purchase of computers one year and then expect not to have to face equipment purchases for another decade. Dan McLaughlin, UCLA, asserts that thousands of dollars are realistically needed each year to keep up with upgrades, new software, maintenance, and training. He suggests budgeting 30 percent of the original purchase price each year for these needs. Evan Culp, Oral Roberts University, observes that most universities amortize equipment purchases over three to eight years. With digital production technology, this is too long. He suggests 12-18 months. Mooberry concurs, noting that people in the industry understand that digital technology becomes obsolete at least every 18-24 months, some even faster, depending on the nature of the technology (e.g., processing chips that are released about every six months with faster speeds).

Partnerships

A few respondents suggest forming partnerships between academic departments and industry firms to assist with budgeting. For example, Wade Roberts, Columbia College, notes that his college has become a midwestern training center for the Avid editing system. This gives Avid a place to host seminars, and it gives his school access to the Avid that it could not afford otherwise. Additionally, universities that provide entry level employees for local production companies might seek to develop financial partnerships with those companies.

Access

One point that many respondents make concerning the competitiveness of students is that access to equipment is a higher learning priority than high-quality output, if the budget is limited enough to force a decision between access and output, as most budgets seem to be.

Process v. product. Process is more important than product, at least for beginning and intermediate level production courses. This means those who make purchasing decisions should buy the greatest number of workstations with the existing money, rather than spending the money on one high-end station. Granted, the

high-end station might have wonderful bells and whistles; it might be able to turn out a fantastic image; and it might even be a system used in the professional world. But if only a few students can access it for only a few hours each day, optimal learning cannot take place. Roberts writes:

> It's damned difficult to teach 15 students trying to huddle around a nonlinear editing station, to engage them (I'm on it; they're behind me), [and] to ensure that they can see and understand what I'm doing.

Thane Chastain, Wichita State University, refers to the "multiple systems" approach to digital learning as the "parallel" mode (many low-end machines working simultaneously) rather than the "serial" mode (one high-end system with a line waiting to get on it). This creates challenges for instructors, such as requiring very short student projects, say one minute or less, due to limited disk space. But the trade-off of greater access (more hours per student per machine) seems worthwhile in bringing to students an increasingly important "digital experience."

German exemplar. Albrecht Schäfer-Schönthal, College of Furtwangen, Germany, argues just that. His Department of Digital Media Studies has the mission of being a high-end training center for German-speaking Europe, and to that end the department has the luxury of a large budget about which most educators can only dream: over US $4 million in 1992 for state-of-the-art equipment purchases. Schäfer-Schönthal notes that out of that budget roughly US $50,000 was allocated for digital video editing. He explains:

> Naturally we bought an Avid. That was the industry standard. It made sense. But it requires so much training that the students can really only get anything done when our technician is there to help them. He only works a 40-hour week, so in essence, we have one digital editing suite available during working hours only. That's not even close to enough time!
>
> If I had it to do again, I would recommend using that same money to buy five low-end systems, maybe Macintoshes with Premiere. Even though professional broadcast video is not edited with that, at least more students would have more time working with digital video and learning the basics. Sure, it's nice to have Avid skills, but if there is too little time to learn the Avid, then Premiere or another low-end application is preferable. Knowing Premiere because you can get access to it is better than knowing nothing because you can't get access to the Avid.

Indiana exemplar. Ron Osgood, Indiana University, agrees. For his editing course, he combines one high-end system (Avid) with three low-end systems (Premiere). He rotates the students among them. He has discovered that the students who learn Premiere first have a relatively short time learning the Avid, and vice-versa. Training on the low-end seems to get the students quite a ways "up the digital learning curve" so that moving to the high-end requires only a little additional learning.

Facilities

Another issue is where to house the digital equipment once it is purchased: ideally under one roof. Mike Wirth, University of Denver, notes the disadvantages of his interdisciplinary Digital Media Program being spread out over several buildings. Though e-mail makes communication very quick and accessible, the old-fashioned "water cooler visits" and "hallway meetings" still allow much camaraderie and decision-making. This argues for bringing all the production facilities and instructors into one building, preferably on the same floor, when that is feasible.

Specifics. Schäfer-Schönthal offers some specific suggestions for housing equipment: Each system should be in a separate room, with sound absorption, ventilation and cooling, comfortable desks and chairs, and good track lighting. Separate rooms keep the sound between systems from spilling over and good ventilation and cooling helps protect the expensive hardware investment from overheating. Comfortable workstations and lighting provide a pleasant atmosphere conducive to creativity -- always more important than technology, and this atmosphere looks professional, giving students the feel that this is serious business, which it is.

Caution. McLaughlin cautions against the desire to develop a multi-departmental "center" to house technology for the entire campus. While this might seem sensible at first, his experience suggests otherwise. He finds technology centers too centralized. The necessary "one size fits all" planning can lead to problems, including: class sizes being dictated by the available seats in rooms, not by the ideal learning environment; scheduling that is less than optimal for lab classes; and central heating and cooling that leaves classrooms too cold and heat-generating control rooms too hot. This centralized administrative control, to which centers lend themselves, can stand in the way of ideal learning with digital media.

Support

Staff. Staff assistance for digital technology is another important consideration. Computers crash. It is already a difficult challenge for instructors to learn the software they use in their production courses; it is realistically too much to expect that they also be experts in the computer systems themselves. A technician is necessary to assist when a computer goes down. Ideally, a staff assistant should be assigned to each production lab. If the budget does not allow for that, an assistant should at least be on call to help when the inevitable systems problems arise. A class can lose a day of lab when a computer locks up. A good technician can literally save a day by being available to fix it.

Manufacturer and supplier. Some errors are more than an "in-house" technician can solve. Sometimes computers come with problems that need to be fixed by the manufacturer or supplier. This points to the importance of purchasing a service contract with equipment. Of course, even with a contract, the equipment is out of commission during the time of repair. This loss of time and expense -- both the cost of a service contract and of shipping and handling to return machinery -- must be factored into course plans and budgets.

Gross argues that getting support is even more important than getting digital equipment. By this she means that grant money is available for computers, but getting people to set up those computers, install the software, prepare the network, train the trainers, and fix the problems is more difficult. All budget proposals must include discussions of money for support people to allow the users of the equipment to utilize it to its maximum potential.

Training

Support staff must be trained with each new and upgraded machine and application. Faculty, too, must be trained. To be sure, training has always been necessary to learn analog equipment, but once learned, it rarely changed. Not so with computers. Upgrades and new programs are part of digital life, and training cannot stop with the first application.

Release v. personal time. Training is ongoing for production faculty and staff. Because of the time necessary for training, faculty and staff ideally should receive release time to keep up-to-date with the technology. In reality, this happens rarely, if ever (no respondents indicated they receive release time for training). More common is that faculty and staff train on their own time in order to try to stay one step ahead of the students.

Part-timers. At times, universities hire part-time instructors who are already trained in the software used in a particular class. Todd O'Neill, Emedia, is familiar with several programs that he uses in producing CD-ROMs, videos, websites, and other electronic media. He was hired as a part-time instructor for an interactive multimedia design class. He admits that if he had not already known the authoring software (Director), he would not have had adequate time to learn it before the semester began.

Educating Administrators

Several respondents discuss how training, as well as staff support, sufficient access for students, and ongoing costs all require some education of those administrators who make budgetary decisions. Ideally, production faculty and staff are compensated with release time and seminar costs for training. Realistically, faculty and staff appreciate whatever acknowledgment administrators can grant them for the extra demands of ongoing training. Ideally, sufficient workstations are available for around-the-clock access for students. Realistically, students appreciate all the access time the university can afford. Ideally, each annual budget allows for some upgrades, new purchases, and technical support. Realistically, faculty, staff, and students appreciate whatever the administration is able to budget. The more administrators understand these real technological needs, the better served are production students, faculty, and staff.

Summary

Potential. The potential for university departments to purchase digital equipment with which students can adequately learn the basics of production is greater than ever and will become even more feasible as equipment prices continue to drop. Universities will likely continue to include digital technology -- and hopefully personnel for installation, training, and maintenance -- in their purchases. To some extent already, and moreso in the years ahead, budgeting will afford students the opportunity to learn production concepts on digital equipment.

Actual. Investing in digital technology, though, costs real money each year, not only for the equipment and software, but for facilities, personnel, support, and training. With this in mind, most departmental budgets do not allow a rapid transition from analog to digital. For the next few years at least, student learning will rely on "technology in transition" as budget decisions gradually bring more digital equipment to the learning environment.

Conclusion

There are many issues to consider in examining the impact of digital technology on video production education. In general, four major topics emerge from the data in this study. These topics concern the impact of digital technology on (1) the production process, (2) curriculum, (3) class interaction, and (4) budgeting. Computer applications affect all phases of production, with the greatest impact in postproduction. Digital video editing offers nonlinear shot access, speed, and the opportunity to experiment with more creative options than does analog editing. These changes must be integrated into the curriculum for students to be prepared for an increasingly digital production market. However, care must be taken to keep the focus of the curriculum on aesthetic concepts, not on technology. With more digital equipment in the class setting, educators will be called upon to facilitate more group interaction as students work in teams to create projects. The hardware and software comes with real costs attached, and budget makers must understand and consider these costs annually when planning what digital technology to purchase to meet the learning needs of students.

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Appendix A

Respondents

1 Aichele, Martin, Chair, Department of Digital Media, College of Furtwangen, Germany
2 Anderson, Grant, Assistant Producer, ***ER***
3 Aylsworth, Wendy, VP, Technology & Facilities, Warner Bros. Feature Animation
4 Ayrouth, George, Owner, MVT Productions
5 Barres, Dean, Producer, *American Gothic*
6 Beam, Sheri, NASA
7 Chastain, Thane, Elliott School, Wichita State University
8 Culp, Evan, Center for Instructional Services, Oral Roberts University
9 Donald, Ralph, Department of Communications, University of Tennessee
10 Edwards, Tom, National Digital Television Center, Telecommunications, Inc., Denver
11 Hedberg, Alexandra, Reporter, Swedish Television
12 Gershon, Peter, Department of Communication Arts, Hofstra University
13 Greenberg, Richard, Vice-President, Creative Affairs, Electric Ideas
14 Gross, Lynne, Department of Communications, California State University, Fullerton
15 Hopkins, Robert, Sony Pictures High Definition Center
16 Jenkins, Shelley, Independent Producer
17 Kearns, Karen, Department of Radio-TV-Film, California State University, Northridge
18 Korpi, Michael, Department of Communications, Baylor University
19 Lowe, George, Feature Story Development, DreamWorks SKG
20 Master, Dave, Manager, Artist Development & Training, Warner Bros. Feature Animation
21 McDonald, Alfajiri, Production Coordinator, News, NBC-4 Los Angeles
22 McLaughlin, Dan, School of Art, UCLA
23 Medoff, Norman, School of Communication, Northern Arizona University
24 Mooberry, Brad, President, Ad Dimension II, Inc.
25 Moore, Tom, Editor, *American Gothic*
26 Musburger, Robert, School of Communication, University of Houston
27 Myerson, Russell, Vice-President, Operations, The Gameshow Network
28 O'Neill, Todd, Owner, Emedia
29 Osgood, Ron, Instructor, Department of Telecommunications, Indiana University
30 Pauling, Brian, Head, New Zealand Broadcasting School
31 Penner, Jim, Executive Producer, *Hour of Power,* Crystal Cathedral
32 Rigney, Eric, Editor, Sony Digital Post Production
33 Riddle, Art, Editor, Royce Multimedia
34 Roberts, Wade, Television Department, Columbia College, Chicago
35 Russ, Reg, General Manager, New Television Applications, Television New Zealand
36 Rust, Mike, Producer, Royce Multimedia
37 Rutenbeck, Jeff, Director, Digital Media Program, University of Denver
38 Schäfer-Schönthal, Albrecht, Dept. of Digital Media, College of Furtwangen, Germany
39 Seel, Pete, Dept. of Journalism & Technical Communication, Colorado State University
40 Shifrin, Steve, Vice-President, Program Production, CBS Studios, Los Angeles
41 Shimizu, Takao, VP, Office of Chief Technical Officer, Tokyo Broadcasting System
42 Snyder, Barry, Vice-President, Post Production Services, Warner Bros.
43 Tyler-Smith, Keith, New Zealand Broadcasting School
44 Voltarel, Vicki, Assistant Editor, ***ER***
45 Ward, Larry, Department of Communications, California State University, Fullerton
46 Whittaker, Ron, Communication Division, Pepperdine University
47 Willis, Saundra, Director of Community Relations, NBC-4 Los Angeles
48 Wirth, Mike, Dept. of Mass Communications and Journalism Studies, Univ. of Denver

Appendix B

Survey Questions

1. How is digital video technology impacting production? What changes occur in the three phases of preproduction, production, and postproduction as a result of new technologies?
2. How is digital video technology impacting the teaching and learning of production? To what extent are the "real world" changes, discussed in the previous question, brought into the classroom, and to what extent *should* they be brought into the classroom?
3. To what extent is learning helped or harmed by new technology? What benefits (strengths) do students and instructors gain from digital video, and what problems (weaknesses) do they face?
4. How does an instructor approach teaching differently with digital media? How is curriculum revised to account for digital technology?
5. How do students approach learning differently with digital video? What do students note as "being different" about what they learn, and how they learn, with new media?
6. How much "hands-on" experience do students need on digital equipment? Balanced against conceptual learning, what are the most important considerations to become effective video communicators?
7. What is unique about your institution, region, and country that impacts the incorporation of digital video technology? What attributes exist there, that do not exist elsewhere, that affect the use of digital video technology for production, teaching, and learning?
8. What other points are important to make about the impact of digital video that are not addressed in these questions? Upon reflection, what else is significant to note concerning how digital technology affects video production and instruction?

Endnotes

[1] One survey question in particular asked respondents what, if anything, is unique about their situations in approaching digital technology. This question was asked to assess their respective contexts rather than to derive any common responses.

[2] A potential downside to the speed of digital editing, at least for editors, is that producers might hire fewer editors because each editor can work faster. Vicki Voltarel, Assistant Editor for *ER*, notes that most hour-long, episodic television programs have three full-time program editors plus one trailer (promo) editor. On *ER*, because of the speed of the Avid, they have only two full-time program editors and a trailer editor.

[3] Simon Frith refers to this process of making aesthetic decisions based on technological possibility rather than on an artistic conception as an "engineering aesthetic." He argues that today's technology causes this engineering aesthetic to replace the traditional "artistic aesthetic." The author has heard several references to Frith's thesis, but after numerous electronic and paper searches has not been able to find a documented reference. If any reader knows the reference, the author would greatly appreciate that information.

[4] While the shift from the lecture paradigm to the interactive paradigm might seem accurate in some courses at some institutions, it is important to note that lecturing skills are far from being a thing of the past. The reality is that lecture classes are larger than ever at many institutions. Wherever funding is based on the number of students in classes ("bums in the seat" as Brian Pauling, New Zealand Broadcasting School, calls this scheme), which is the case at many universities, departments have incentives to offer large, general education lecture classes to "subsidize" the smaller seminars and labs. Like e-mail leading to more paper and digital video leading to more analog tape, the more money and rhetoric spent on interactive learning, the larger the traditional lecture classes to fund all those computers and small faculty-to-student ratio courses needed for truly meaningful "interactive" learning. The point concerning instructional training in the digital age is that educators require both traditional lecturing skills and interactive skills to facilitate student learning.